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Continuous monitoring and modelling of cyanobacteria dynamics in urban lakes

Application to Lake Enghien, France and Lake Pampulha, Brazil

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Sciences, Ingénierie et Environnement

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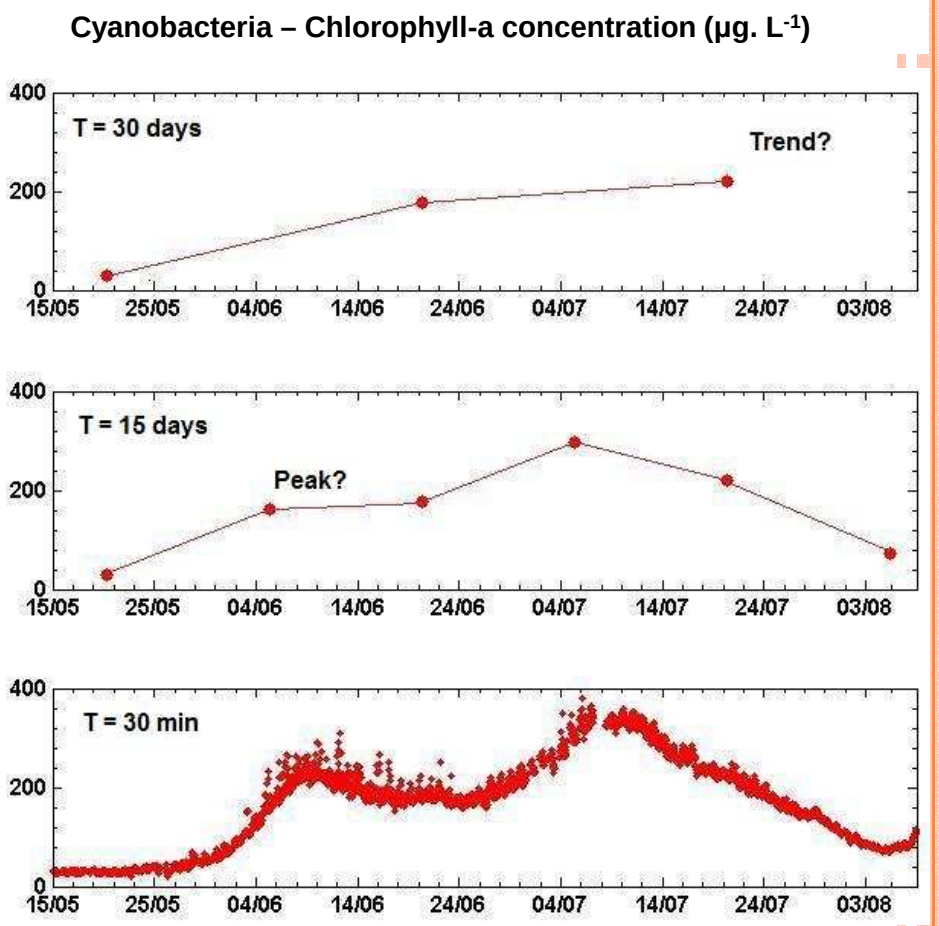
Outline

- Cyanobacteria monitoring
- Proliphyc project
  - Measurement buoy
- Lake Enghien
  - Monitoring
  - Modelling
- Lake Pampulha
  - Monitoring methodology
  - Integrated modelling approach
  - Expected results
- Conclusions

LIMITS OF THE USUAL MONITORING

- Cyanobacteria monitoring
  - How it is usually done

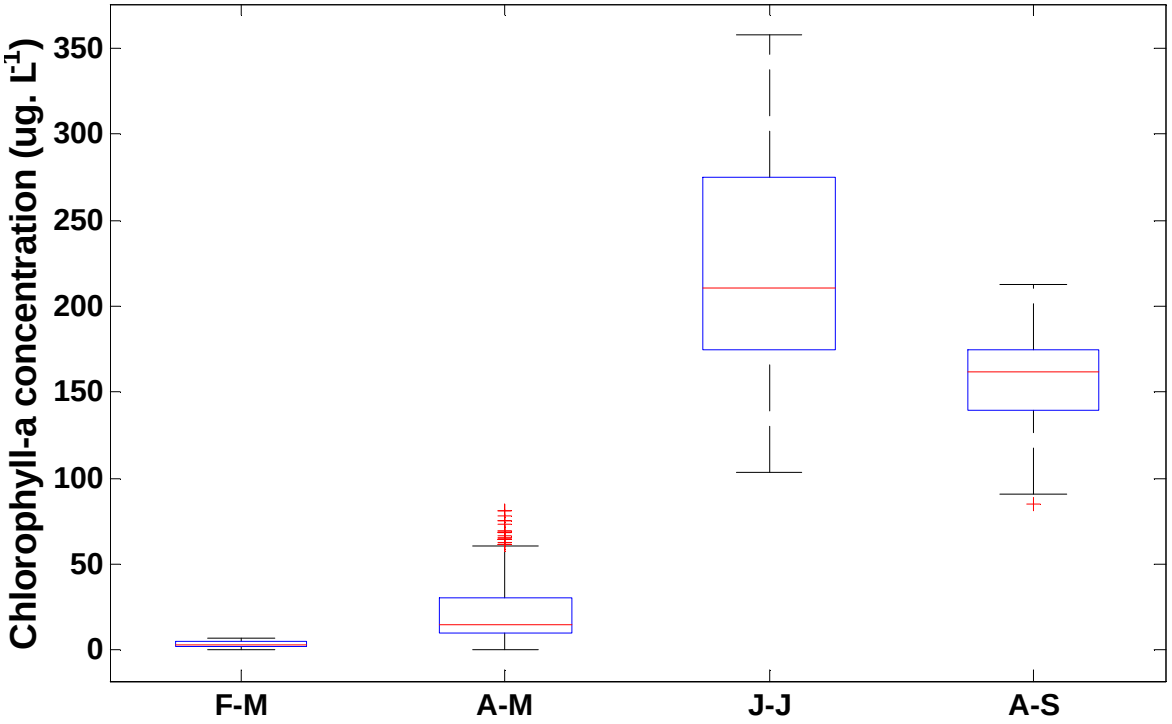
  - How we propose to do it

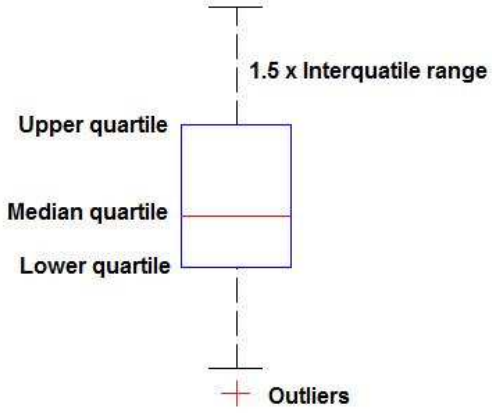


BENEFITS OF HIGH-FREQUENCY MONITORING

French protocol (European WFD)

- 4 sampling campaigns/year
  - Including 3 during the summer
- 3 weeks = minimum interval between the campaigns



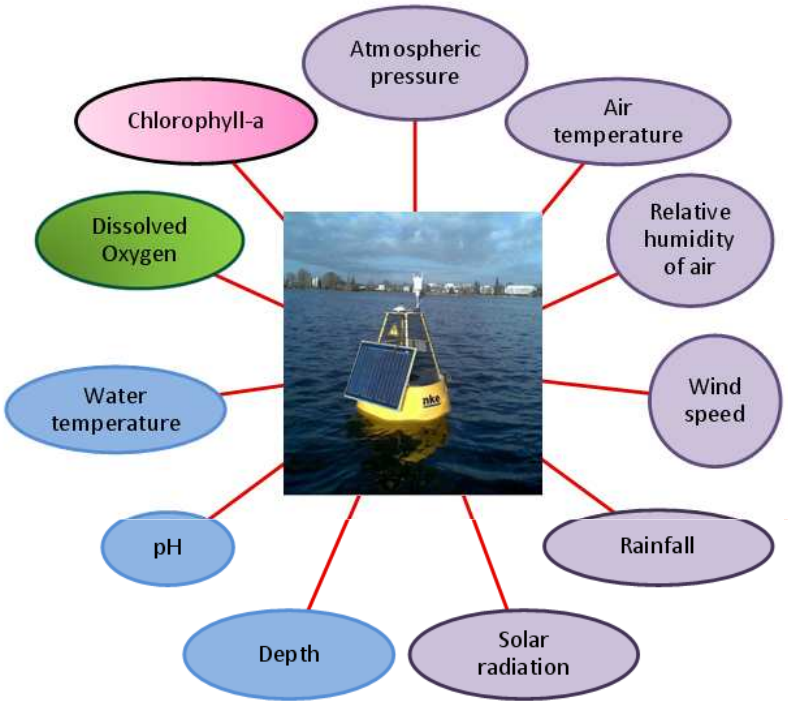


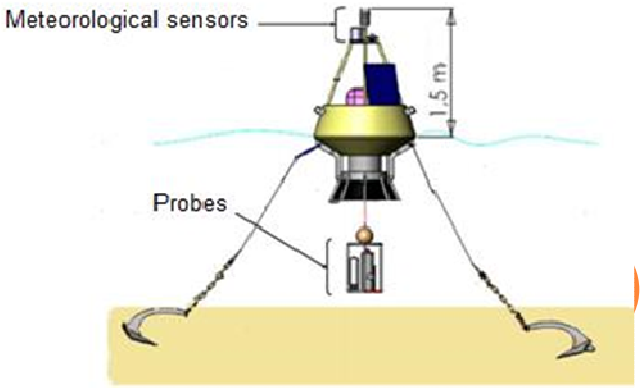
ANR PRECODD
PRogramme de recherche
ECOtechnologies et Développement Durable
ADEME

PROLIPHYC PROJECT

- A measuring buoy
  - High-frequency data (15-30 min)
  - Data teletransmission (daily)
- Warning system
  - Based on the weather forecast and buoy measurements
  - Short-term predictive modelling

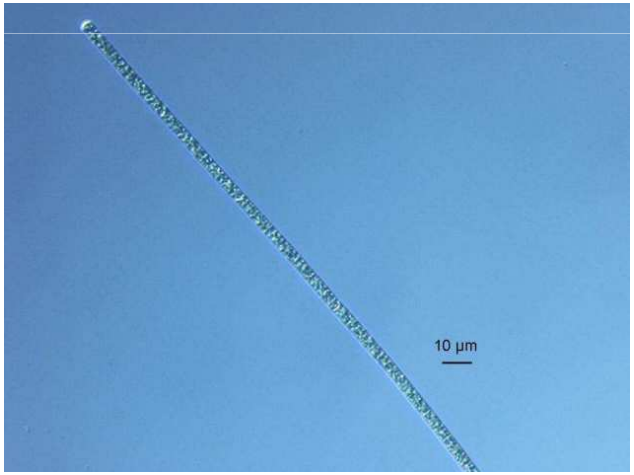
(1 week)





LAKE ENGHIEN-LES-BAINS

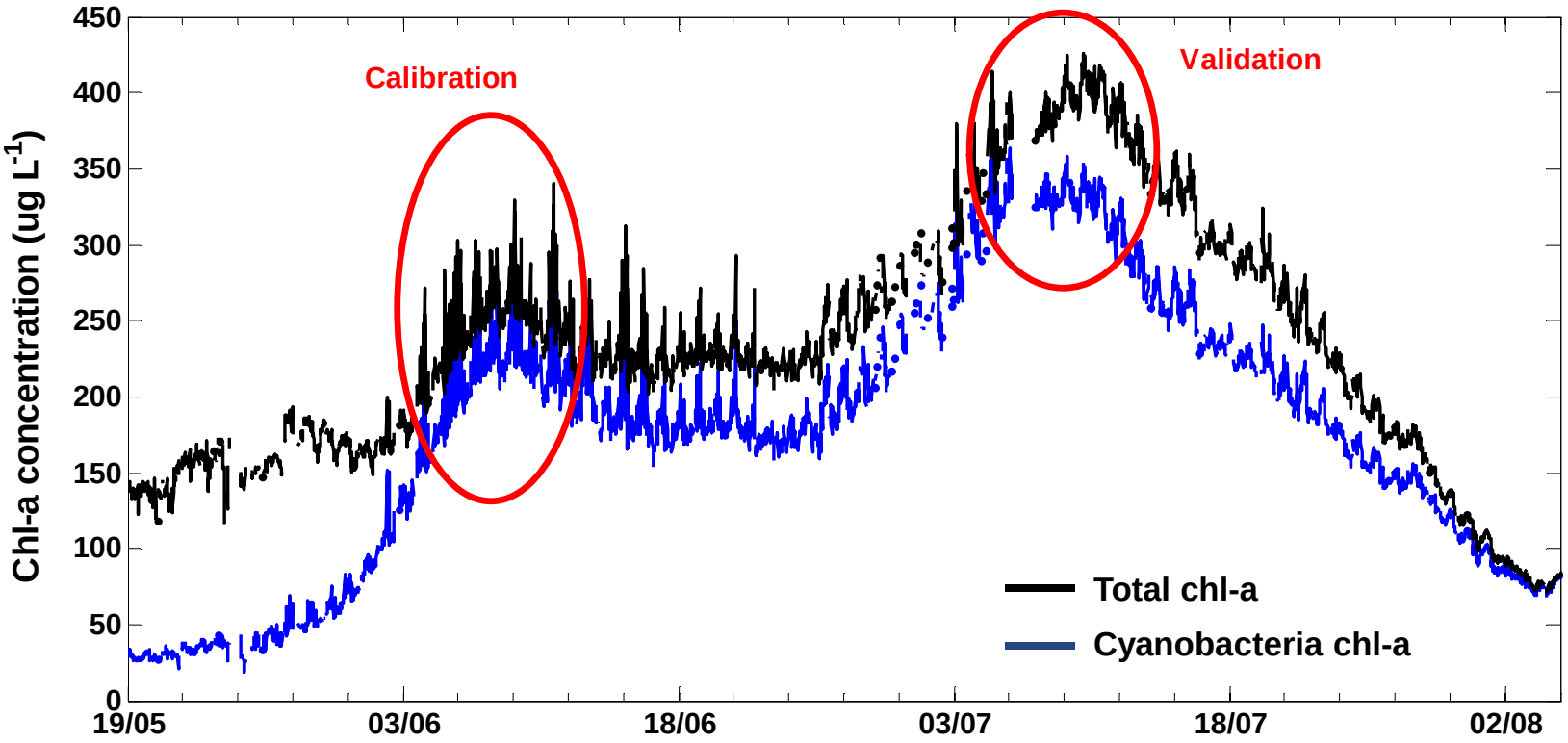
- 41 ha, mean depth = 1.5 m
- Rainwater storing, sport, landscape
- Inappropriate wastewater discharges
- *Planktothrix agardhii* blooms



(Escoffier 2008)

MODELLING

- DYRESM-CAEDYM model (Centre for Water Research, University of Western Australia)
- 1 phytoplankton group: cyanobacterium *Planktothrix agardhii*
- Model calibration and validation

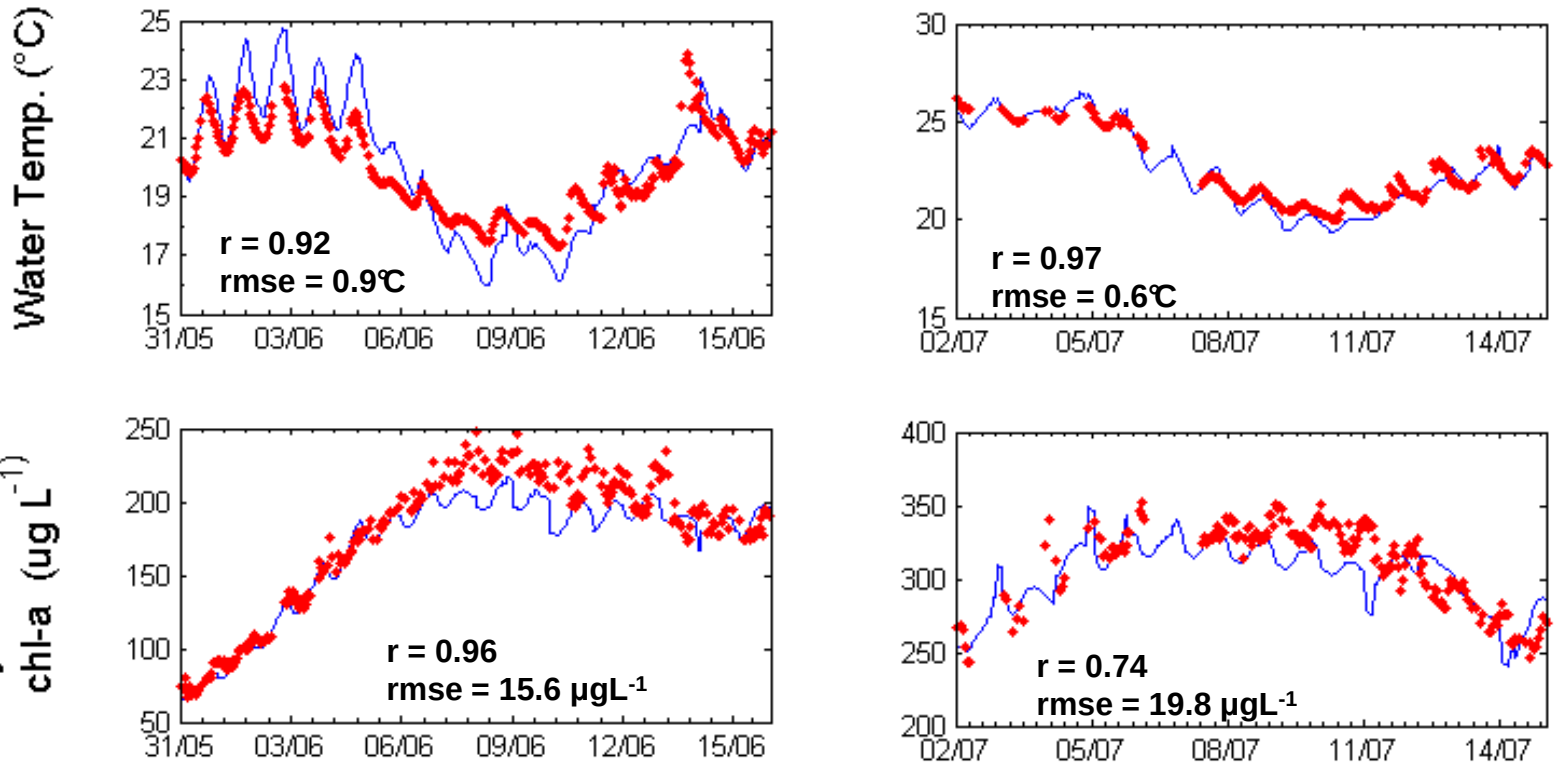


DYCD RESULTS

- Model results show good agreement with measurements
- High frequency data → thorough assesment of results
  - Gal *et al.* (2009); Burger *et al.* (2008); Hornung (2002)
  - Medium-term simulations, hourly time step

Calibration period 1-16 June 2009

Validation period 2-16 July 2009



Depth : 0.75 m

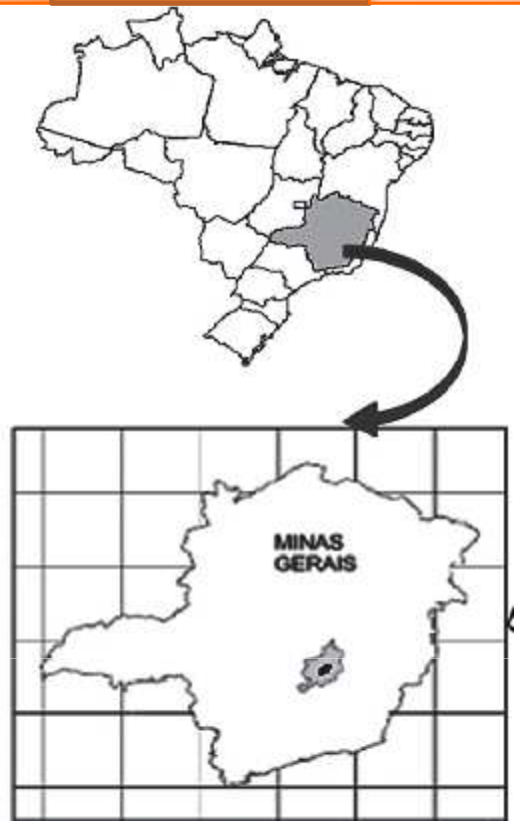
LAKE PAMPULHA

- Belo Horizonte, Minas Gerais, Brazil
- 197 ha, 10 hm^3, 5,0 m (mean depth)
- Former drinking water source

Urbanization + no sanitation infrastructure + no erosion control

lake silting and storage capacity reduction

- Cyanobacteria blooms and macrophyte growth
- Touristic spot
  - Fishing, sailing, landscape



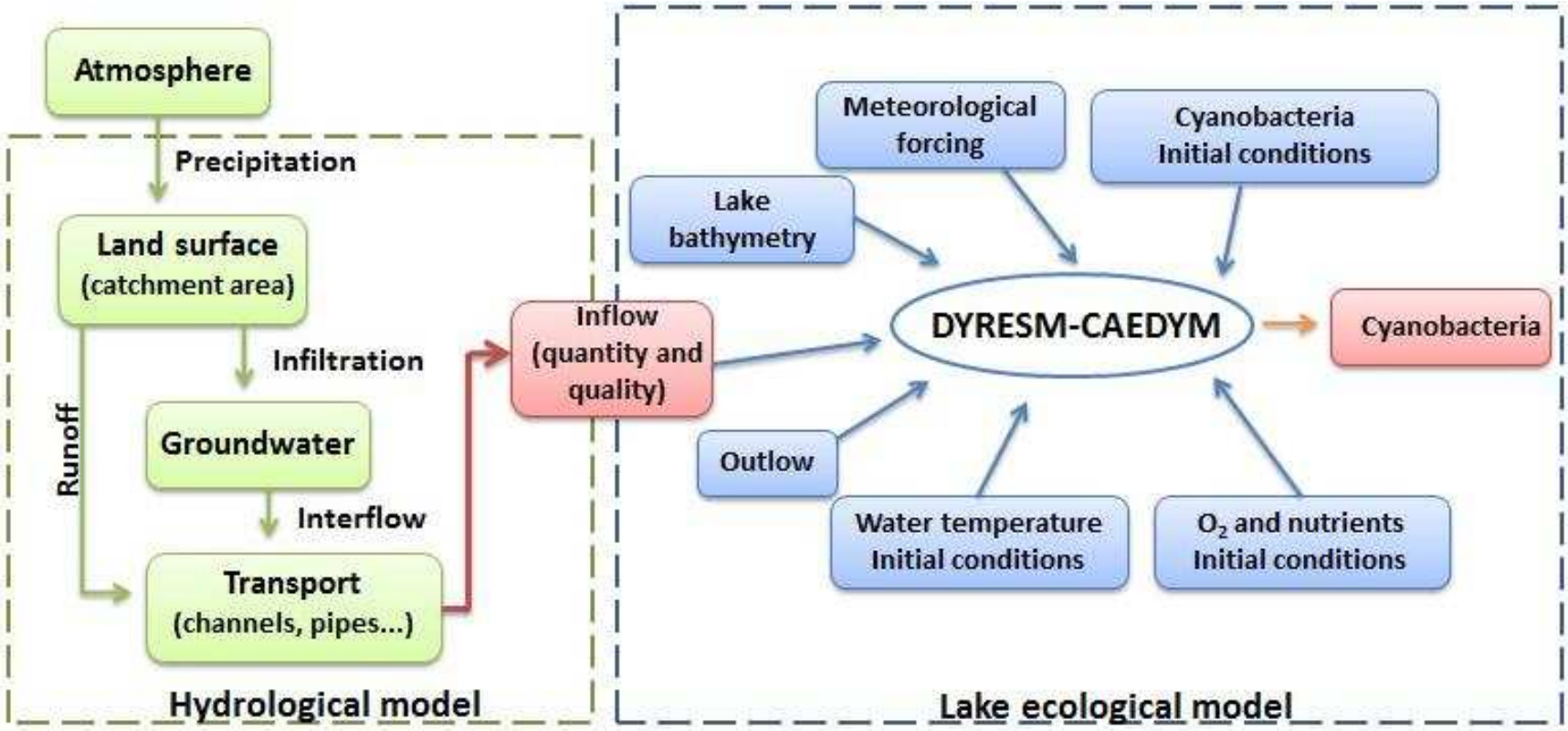
WATERSHED AND LAKE MONITORING

- High frequency data*
  - Two main tributaries and lake outlet :
    - Rain gauges
    - Flow rate
    - Temperature, conductivity and turbidity
    - Automatic samplers: nutrients and dissolved oxygen
  - Measurement buoy :
    - Temperature, conductivity, pH, O_2 and chl-a
  - Meteorological forcing : INMET

*MAPLU project: Funded by FINEP (Brazilian Research Agency)

INTEGRATED APPROACH

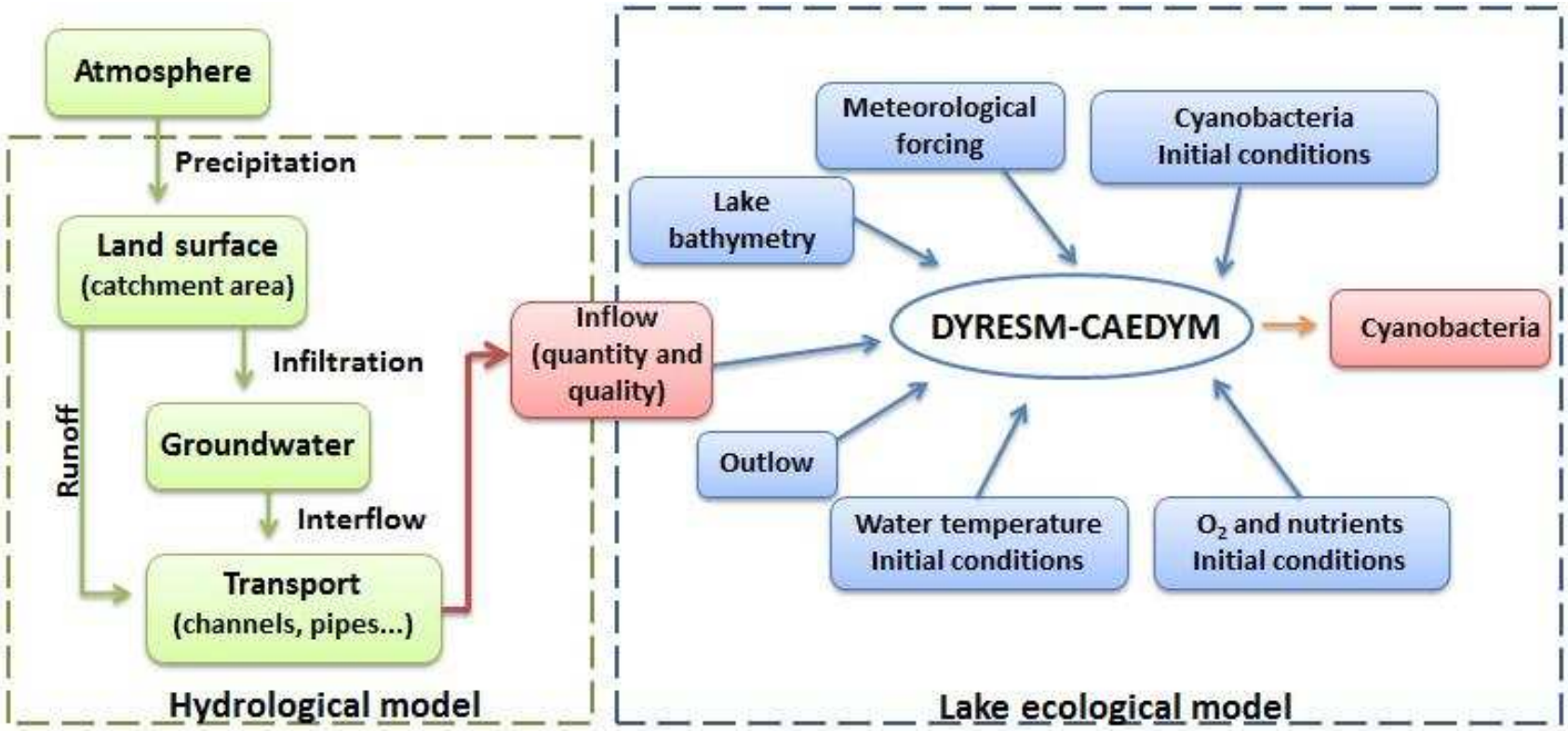
- Watershed hydrological model +Lake ecological model



Why a modelling approach?

INTEGRATED APPROACH

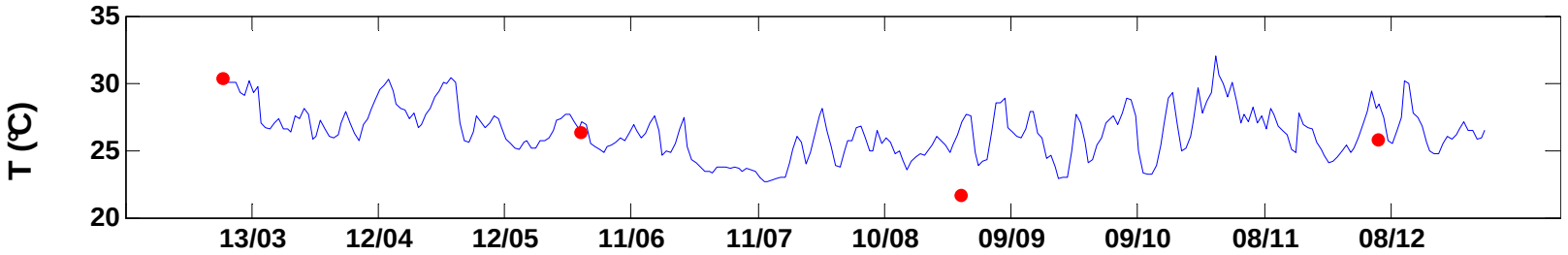
- Watershed hydrologic model +Lake ecological model

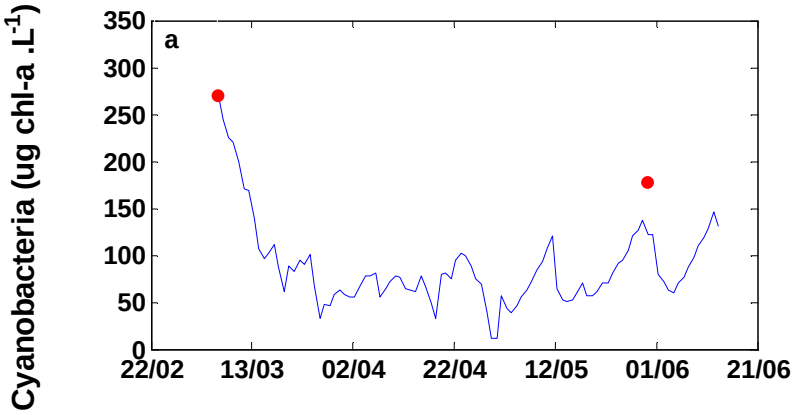


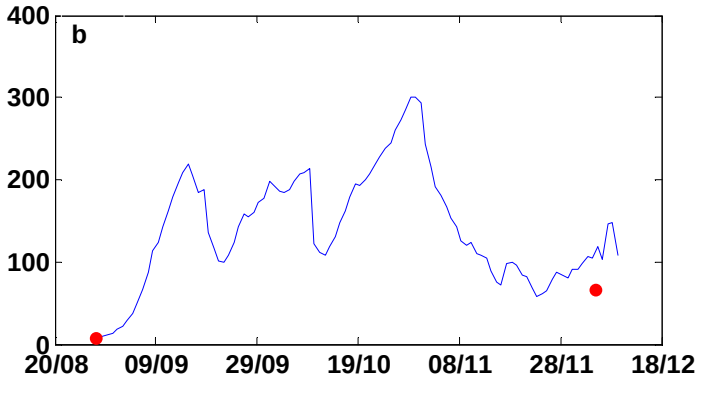
Lake response x Different scenarios of watershed evolution:
Land-use changes, impervious area expanding…

LAKE ECOLOGICAL MODEL

- Belo Horizonte municipality data
- Cyanobacteria species:
  - *Nostocaceae, Microcystis wesenbergii, Sphaerocavum sp.*
- Cyanobacteria modelling: on-going







CONCLUSIONS

- Lake Enghien
  - Warning system
  - High frequency lake monitoring
  - Cyanobacteria dynamics modelling
  - Few data about the catchment

- Lake Pampulha
  - Management tool
  - High frequency watershed monitoring *in progress*
  - High frequency lake monitoring *from September/2011*
  - Cyanobacteria dynamics modelling *preliminary results*
  - Watershed modelling and scenarios

THANK YOU FOR YOUR ATTENTION!

Source : http://stcroixcourier.ca/fullnews.php?view=337